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The Moving Boundaries of Sea Level Change: Understanding the Origins of Geographic Variability

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Authors

Mark E. Tamisiea | National Oceanography Centre, Liverpool, UK

Jerry X. Mitrovica | Department of Earth and Planetary Sciences, Harvard University, Cambridge, MA, USA

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Abstract

As ice sheets gain or lose mass, and as water moves between the continents and the ocean, the solid Earth deforms and the gravitational field of the planet is perturbed. Both of these effects lead to regional patterns in sea level change that depart dramatically from the global average. Understanding these patterns will lead to better constraints on the various contributors to the observed sea level change and, ultimately, to more robust projections of future changes. In both of these applications, a key step is to apply a correction to sea level observations, based on data from tide gauges, satellite altimetry, or gravity, to remove the contaminating signal that is due to the ongoing Earth response to the last ice age. Failure to accurately account for this so-called glacial isostatic adjustment has the potential to significantly bias our understanding of the magnitude and sources of present-day global sea level rise. This paper summarizes the physics of several important sources of regional sea level change. Moreover, we discuss several promising strategies that take advantage of this regional variation to more fully use sea level data sets to monitor the impact of climate change on the Earth system.

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